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RACIC report

(U) SWAMP FOREST WARFARE: SUMMARY

Report No. BAT-171-45-1

Prepared Under Contract SD-171

May 16, 1966

by

J. A. Bontadelli, K. L. Nielsen, and W. P. Virgin

REMOTE AREA CONFLICT INFORMATION CENTER
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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(U) SWAMP FOREST WARFARE: SUMMARY*

by

J. A. Bontadelli, K. L. Nielsen, and W. P. Virgin

INTRODUCTION

(C) This study is the result of a request by the Director, OSD/ARPA Research and Development Field Unit in Viet Nam and is based on a requirement of the Chief, Naval Advisory Group, U. S. Military Assistance Command in Viet Nam. It is a limited study of applicable weapon systems, general operational concepts, and associated problems and requirements of combat operations in the swamp forest areas of South Viet Nam. A discussion of the study and the findings are summarized here.

(C) The objectives of the study are:

1. To describe the physical characteristics of the swamp forest areas of South Viet Nam with emphasis on the Mekong Delta and the Ca Mau Peninsula.

2. To describe the threats and potentials of swamp forest warfare in South Viet Nam.

3. To describe the United States inventory of weapons systems applicable to swamp forest warfare.

4. To provide a survey of the state of the technical art in the areas of swamp forest weaponry.

5. To relate the results of 1 through 4 above in such a way as to portray

   a. Preferred weaponry inventories for swamp forest warfare

   b. Preferred operational concepts for weaponry indicated above

*This is a concise summary of the report (U) "Swamp Forest Warfare", BAT-171-45, dated May 16, 1966, prepared by the Remote Area Conflict Information Center, Battelle Memorial Institute, Columbus Laboratories.

c. Research and development required to improve capabilities that currently exist.

(C) An additional objective was to consider the feasibility and effectiveness of denying potable water in the saline swamp forest areas.

(C) The scope of the above objectives required that a qualitative analysis approach be used to accomplish the study. In addition, two swamp forests in the Mekong Delta and Ca Mau Peninsula were selected for primary emphasis in the study because of their strategic interest. These areas are the Rung Sat Special Zone and the Nam Can Forest. The location of these two areas (and the U-Minh Forest) is shown on Map 1.

(C) In the conduct of the study the approach was first to describe the general environment of the swamp forests. A more detailed description was accomplished for each of the two selected areas. Information and data for environmental descriptions were obtained from several reports, aerial photographs, and detailed interviews with American Military Advisors who had experience in the various areas. Four photomosaics were made from aerial photograph coverages. The one of the entire Rung Sat Special Zone was made from 1:25,000 aerial photographs, and the three sectors of the Nam Can Forest were made from 1:10,000 aerial photographs. Individual areas were studied by stereo equipment, and enlargements were made of selected locations. In addition, an aircraft flight over the principal swamp forest areas was accomplished by one member of the analysis team.

(C) The second phase of the qualitative analysis involved (1) obtaining the basic operational characteristics on selected equipment and weapons in present inventory which have potential application to combat operations in the swamp forest areas, and (2) development of representative operational concepts through general tactical plans for the Rung Sat Special Zone and the Nam Can Forest. (The assumed military objective in each area was its present and future denial as an effective VC support base.) These representative operational concepts then served as a base, and the general tactical plans provided a structure, for qualitatively screening the present inventory of equipment and weapons against operational needs. Based on this screening, preferred items in the present inventory and areas requiring improved operational capability were identified. The general tactical plans also illustrated the tactical concepts and integration and employment of weapon systems in the two specific swamp forest environments.

(C) In the third phase of the study, general concepts of operation applicable in the swamp forests of the Mekong Delta and the Ca Mau Peninsula were extrapolated from the two specific general tactical plans. Also in this phase, emphasis was placed on the research, development, test, and engineering effort which appeared required to provide improved operational capability.

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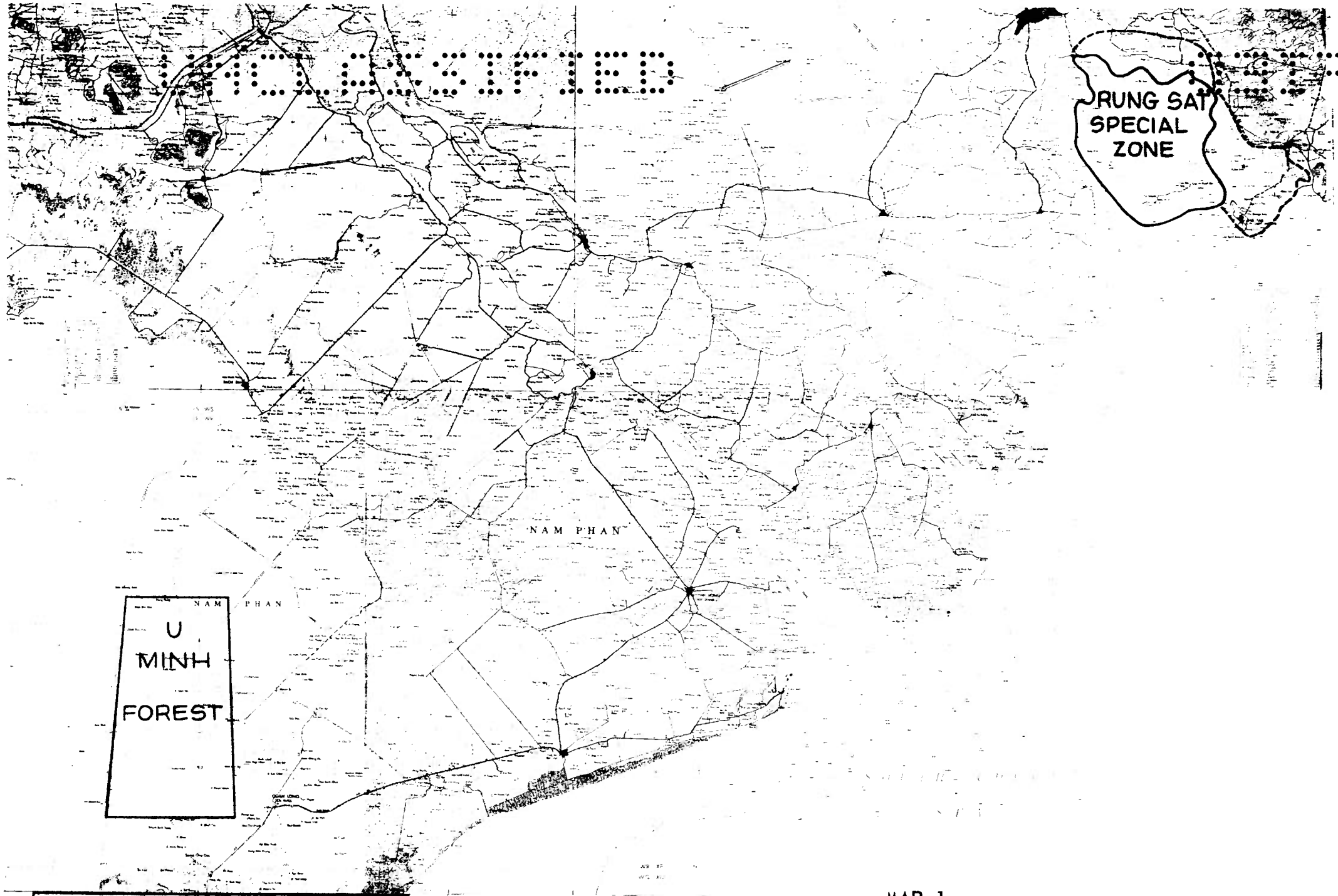

MAP 1

SOUTH VIET NAM

(MEKONG DELTA AREA)

LOCATIONS OF

RUNG SAT SPECIAL ZONE

NAM CAN FOREST

U MINH FOREST

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SUMMARY DISCUSSION

(S) The swamp forest areas of the Mekong Delta and Ca Mau Peninsula are part of an integrated haven system supporting VC guerrilla and main force operations. The primary integrated haven system in the southern portion of South Viet Nam consists of Zone D, the Boi Loi Forest, Zone C, the Plain of Reeds, the Rach Gia area northwest toward the Cambodian border, the U-Minh Forest, the Nam Can Forest, and the swamp areas along the South China Sea littoral. The Rung Sat Special Zone anchors the northern portion of the swamp forest areas along the South China Sea littoral. This primary VC haven system forms a perimeter of interconnected, mutually supporting areas in the southern portion of the country. It is this fact that emphasizes the potential benefits of progressive operations against the system through the initiation of continuous operations against selected haven areas. The Rung Sat Special Zone and the Nam Can Forest which are given emphasis in this study, are key haven areas in the system and illustrate the strategic potential of swamp forest warfare in South Viet Nam.

(S) The Rung Sat Special Zone is valuable to VC operations because of its location. It is close to the major population and logistic center of Saigon and adjoining areas, and contains the oceangoing ship channel connecting the Saigon port complex to the South China Sea. As part of the integrated VC haven system it provides a northeast-southwest line of communication south of Saigon, with some medical, communication, resupply, and rest facilities for guerrilla or main force elements in transit. It also supports local guerrilla unit operations.

(S) The Nam Can Forest in the southern portion of the Ca Mau Peninsula provides the link in the haven system between the areas along the South China Sea littoral and the Gulf of Siam littoral. Its strongest interconnecting links are north to the U-Minh Forest. The physical characteristics of the area provide the potential for major access from sea routes and intracoastal movement. Strategically, its use by the VC as a support base is a primary threat to the attainment of relative government control in the Ca Mau Peninsula.

(C) The development of the general tactical plans for the Rung Sat Special Zone and the Nam Can Forest clearly illustrated two basic principles:

1. Sustained combat operations to attain the present and future denial of a swamp forest area as a VC support base required integrated air, ground, and inland waterway operations

2. Specific operations and techniques must be planned and adapted to the threat and characteristics of the particular area.

(C) These two principles appear applicable in general to the swamp forest areas in South Viet Nam, and are based on the fact that significant differences exist in the VC threat and the environment. In general, the swamp forests which are integral parts of the primary VC haven system contain training, munitions manufacture and repair, supply storage, essential clothing and equipment manufacture, medical, communications, and resting facilities. However, the primary role of a particular swamp forest area in the haven systems depends upon its location, physical characteristics, and local guerrilla and main force support requirements. This results in the significant differences in the specific threat.

(C) The differences in the primary environmental factors such as (1) the extent of an inland-waterway system, (2) saline or fresh water, (3) rainfall and other climatical factors, (4) extent of contiguous land areas within and around the swamp forest, and (5) maturity and type of the principal vegetation, among the various areas were found to be significant from a combat operations viewpoint. As an example, the extent of the inland-waterway system in the Rung Sat Special Zone is a primary factor. In the Nam Can Forest a less extensive system is available but adequate for exploiting as the principal lines of communication. However, in the U-Minh Forest the inland-waterway system will not permit its use as the primary lines of communication.

(C) Based on the assumed military objective of the present and future denial of a swamp forest area as an effective VC support base, and the general tactical plans which were developed for the Rung Sat Special Zone and Nam Can Forest, a general concept of operations in swamp forests can be considered in five parts. These are discussed below.

Interdiction

(C) The first general concept of operation is to interdict the primary lines of communications providing access and egress to the swamp forest area. This will weaken the insurgent capability within the selected area to respond to subsequent combat operations. The required method of interdiction will depend upon the VC threat and the environmental characteristics of the specific area.

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Isolation

(C) The expected insurgent reaction to operations against the primary lines of communications would be attempts to "spread-out" these lines which afford access and egress, or to take a stand and fight. The latter is a desirable result which could be countered by superior firepower. If the lines of communications are spread out however, further effort to isolate the area would be required. The concept is to supplement the combat operations of interdiction sufficiently to establish corridors around the swamp forest area within which relative control is maintained. This would have the effect of isolating or "cushioning-off" the swamp forest area from the larger haven system or sources of direct support. The plan for establishing the control corridors is again dependent upon the specific characteristics of the area and the nature of the threat.

Attrition

(C) The "cushioning-off" of a swamp forest area sets the stage for application of the third general concept of operations - that of attrition of the insurgent elements and support base by an appropriate level of continuous combat operations and harassment. For the eventual success of the military mission it is this concept which requires the greatest attention and is discussed in more detail.

(C) Continuous combat operations at a level commensurate with the threat are stressed. Intermittent clearing actions in force, even though they have a significant effect on insurgent operations, will not attain the desired minimum military objective of denying to these elements the present and future use of the area as an effective support base. The continuous application of combat operations and other harassing techniques is required to (1) increase the effectiveness with which the area is isolated, (2) develop adequate intelligence for responsive day-to-day control of operations, (3) direct operations to attain the necessary attrition rate, and (4) provide the shield and support required for rural construction.

(C) The requirement for integrated air, ground, and inland-waterway elements in the force structure to effect the necessary combat operations in a swamp forest has been emphasized. The required balance of force elements in each case is dictated by the threat and environmental characteristics. However, the essential point is that the primary factors in effecting attrition and attaining area control are well planned combat operations adapted to the threat and area characteristics, and persistently applied. Special operations and techniques which supplement the effect of the conventional combat operations are required, but the primary attrition and area control factors from a military viewpoint are the adapted combat operations.

(C) Ground movement is difficult in a swamp forest. The degree of mobility by means of inland-waterway transportation which may be attained for ground force elements will vary widely with the specific area. In each specific case it is essential to exploit the existing potential for using the inland-waterways as lines of communications. In both of the example swamp forest areas, inland-waterways operations were a primary part of the representative operational requirements. Any swamp forest area with major rivers or channels has this requirement. The inland-waterway operational requirements will encompass patrolling; troop, cargo, and equipment transport; convoy protection and fire support; mobile command and control; mine countermeasures; barricading of secondary channels; and general mobile support of watercraft, and rotary and light fixed-wing aircraft. Even though the inland-waterway operational concepts for swamp forest warfare will vary more than the air and ground operational concepts among specific areas, they are a critical part of the total swamp warfare capability.

(C) In the paddy land which usually adjoins a swamp forest, and in the shallow water, mud, and marsh interspersed in a swamp forest where movement by watercraft is restricted, some degree of improved mobility may be attained with amphibian type vehicles. However, the effective use of these vehicles where applicable will require detailed planning and operational control. Terrain information available only with large-scale photomosaics (maintained current with local intelligence) is required to avoid the impassable dikes, canals, and ambush sites.

(C) Heliborne operations in swamp forest areas provide some degree of independence from the surface mobility problems of ground operations. However, the landing site problem places a significant constraint on operational flexibility. This is especially true during initial operations in an area before the progressive development of landing sites has been accomplished.

(C) The use of rotary and light fixed-wing aircraft is essential to a continuous capability for operations and harassment. The proper mix of the two systems in the area force is dependent on the particular swamp forest area. In general, the helicopter is best employed in supplementing and supporting the inland-waterway operations, and in a utility support role. The light armed reconnaissance type aircraft provides the needed operational capability for area observation, fire control, close ground support, and armed reconnaissance. There is, of course, some overlap of capability among the two types of systems to perform the required air missions.

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(C) The required ground operations in swamp forest areas directed toward the attrition of the insurgent elements and support base may be categorized as (1) clearing operations involving actions in force, and (2) extensive small unit patrol and ambush operations. The clearing operations are effective against both the insurgent forces and base facilities. Extensive small unit patrol and ambush operations are required to restrict the flexibility of movement of the insurgent elements, provide relative security to villages and other key areas, and develop the necessary intelligence for operational control. The requirement for effective small unit operations day and night cannot be overemphasized. A clear example of this is in trying to maintain relative control in a corridor where ground operations have to be primarily used. The effectiveness of the control corridor in this case is directly a function of the small unit patrol and ambush operations. Periodic patrols in force will not accomplish the task.

(C) Fire support is a critical factor in maintaining constant pressure on insurgent elements in swamp forest areas. Where fire support is available through ground artillery and/or naval gunfire, the capability exists to respond immediately to any exposure of the insurgent operations. Without this dimension in the force balance, targets of opportunity cannot be adequately attacked except by close air support on station.

Special Operations

(C) The fourth general concept of operations is to supplement the harassing effect of continuous combat operations by integrating special techniques which take advantage of specific physical or demographic characteristics of a swamp forest area. As an example, in the saline swamps, the availability of potable water during the dry season is restricted. Control and denial measures directed toward this critical resource would be effective. The inland-waterways patrols and mobile checkpoints should place specific emphasis on controlling the primary distribution method which is containers on local watercraft. Ground troops conducting clearing operations should ensure the destruction of all containers and rainwater catch systems, and identify the location of ground catch basin areas or local wells for further denial actions.

(C) The general environment of any swamp forest area places an increased burden on insurgent elements living outside the established village areas. This factor, in combination with harassment from continuous combat operations, should increase the receptiveness of the individual insurgent to psychological warfare. In its application toward the insurgent elements, the psychological warfare effort should be viewed as an extension of combat operations and controlled and integrated as such. It can also be used effectively to reduce the willingness of elements of the local population to support insurgent operations.

(C) Population control techniques are applicable in a swamp forest area, and the relatively low density of population aids implementation. (The population among different areas, however, can vary considerably based on the amount of agricultural land within and immediately adjoining the area and other local industries such as fishing and woodcutting.) Relocation measures to place all personnel within the primary village structure may be feasible and affect a small percentage of the population. Where feasible, this removes some of the constraints on combat operations and decreases the difficulty of identifying insurgent operations.

(C) Defoliation in swamp forest operations is required to limit the advantages of cover and concealment to the VC operations. If the swamp forest contains a river or channel network, defoliation programs should be maintained current along the major lines of communication to increase the difficulty of a successful ambush. Other applications would be to degrade or clear the vegetation cover in selected areas. As an example, in the Rung Sat Special Zone the VC support facilities are often established on the small areas of micro-relief scattered throughout the zone. The permanency of clearing operations in these areas could be enhanced by subsequent defoliation. In some cases the destruction of food crops would also be required.

(C) The burning of extensive areas in the Rung Sat Special Zone (or the Nam Can Forest) does not appear feasible. In addition to the problem of the water content of the primary foliage and general inundation of the area, the numerous streams and channels form an extensive system of small, natural firebreaks. This, combined with the variation in density of the vegetation and crown heights, does not present favorable conditions for sustaining a forest fire and attaining a general area of burn.

Central Command and Control

(C) The coordination and control of continuous operations is a factor which requires particular attention. The planning and control of day-to-day operations in any of the major swamp forest areas of the Mekong Delta and Ca Mau Peninsula would involve civil and military operations. This leads to the fifth general concept of using a combined combat operations center as the coordination element. That is, a suitable structure for central coordination of military and civil requirements. The purpose of the center would be to decrease the response time, provide for improved development of intelligence, and ensure the integration of military operations with civil program requirements.

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SUMMARY OF FINDINGS

General

(S) The threat posed by the use of the swamp forest areas of the Mekong Delta and Ca Mau Peninsula by the VC, and the potential of swamp forest warfare against this threat, both emanate from the fact that these areas are part of an integrated VC support system. Their use as VC support bases has established a level of relative insurgent control which is precluding rural construction within these areas, and is critical to VC operations in several areas of the Mekong Delta and Ca Mau Peninsula. Friendly initiated and sustained combat operations, commensurate with the specific threat and environment, in the swamp forest areas such as the Rung Sat Special Zone and the Nam Can Forest would deny the VC these key haven areas. The support of large-scale VC operations in the affected areas would then become extremely difficult, and the total VC haven system would be progressively weakened.

(C) There are significant differences in both the VC threat and environment characteristics among the swamp forest areas of the Mekong Delta and Ca Mau Peninsula. In each case, integrated air, ground, inland-waterway operations are required to attain the minimum military objective of denying the present and future use of the swamp forest area as an effective VC support base. However, the differences in both the VC threat and environment dictate that the mix of force elements be tailored to the specific requirements.

(S) Effective combat operations may be conducted in the swamp forest environments of the Mekong Delta and Ca Mau Peninsula with the equipment and weapons in current inventory. However, the qualitative analysis conducted in this study which compared representative operational concepts for these environments with current equipment and weapon capabilities revealed areas where improvement is required. Consideration of these areas from a research, development, test, and engineering viewpoint indicates that the desired improvement in equipment and weapon characteristics is basically within present technical capability. The necessary actions required to attain the improvements are discussed in the research and development paragraphs.

(C) A list of preferred inland-waterway and light aircraft systems from current inventory for use in swamp forests (containing a major river or channel network) is exhibited in Tables 1 and 2.

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TABLE T: PREFERRED EQUIPMENT AND WEAPONS
(Inland-Waterway Operations)

Operational Concepts	Preferred From Current Inventory
1. Patrolling and operation of mobile checkpoints	PBR; Swift; modified LCPL
2. Support of amphibious operations	
a. Troop, equipment, and cargo transport	Armored LCM (3), (6), and (8); Armored LCVP; STCAN; modified LCPR; modified LCPL
b. Convoy protection and fire support	LCM Monitor; LCM Commandament; STCAN; PCF-Mark 1 (Swift)
c. Mobile command and control	LCM Commandament
3. Mine countermeasures	Chain drags; modified small craft sonar
4. Blocking of secondary channels	Field expedients; shallow-water mines
5. Mobile general support, watercraft and aircraft	Modified LST; modified LSD
6. Offensive and defensive fire-power from watercraft	0.30 Cal. (or 7.62 mm) M.G.; 0.50 Cal. M.G. (Twin or single); 20 mm gun; 40 mm gun; 81 mm naval mortar; LV 40 mm grenade launcher

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TABLE 2. PREFERRED EQUIPMENT AND WEAPONS

(Air Operations)

Mission (Organic Support)	Rotary System Type	
	Rotary	Fixed
Night patrols - curfew enforcement on waterways	X	
Air escort of specific water movements	X	
Air cover over length of main channel(s)		X
Fire suppression in support of ground operations	X	X
Daylight armed reconnaissance		X
Attack of targets of opportunity	X	X
Control of direct fire support		X
Control of tactical air support		X
Support of special programs	X	

Rotary wing organic support: UH-1B - 7.62 mm M. G.; 2.75" FFAR; 40 mm G. L.; BLU-3/8 Frag. bombs, illumination system.

Fixed wing organic support: 0-1 - Replace with light armed reconnaissance type aircraft.

(C) Although the use of special operations to supplement the combat operations is self-evident, the saline swamp forest environment calls for emphasis on the denial of potable water and psychological warfare. Effective potable water denial actions can be a part of inland-waterway and ground operations during the dry season. It is feasible to supplement these actions by various contamination techniques as discussed in the detail report.

Research and Development

(S) The requirements for improvement in present equipment and weapon capabilities to conduct inland-waterway operations in a swamp forest containing a major river or channel network are the most urgent. Because of this, these requirements are given priority. The major feasible improvements required in ground operations are also included in the inland-waterway requirements under support of amphibious operations. The principal requirement for increased capability in air operations is in night operations – particularly with regard to curfew enforcement.

Inland-Waterway Operations

(C) The improvements which appear required for inland-waterway operations in a swamp forest containing a major river and channel network may be considered in two parts. The first part is the research, development, test, and/or engineering effort in supporting type projects – particularly in the common deficiency areas associated with current craft. (See Table 3 for a summary of general improvement required in inland-waterway operational capability.) This effort should result in the capability to significantly improve the characteristics of new craft with regard to these present deficiencies. The second effort is that associated with the development of new craft for some of the operational requirements. The priority is for new craft associated with the "support of amphibious operations" and "mine countermeasure operations".

(C) Supporting Projects. Five common deficiencies in craft available in current inventory for inland-waterway operations are the resistance of the hull to underbottom explosions, subtained and maximum operating speeds, integral armor protection, weapon complement capability to deliver anti-personnel munition on an area target, and noise suppression. The research, development, test, and/or engineering effort which appears required in these areas is summarized in Table 4.

TABLE 3. SUMMARY OF GENERAL IMPROVEMENT REQUIRED IN OPERATIONAL CAPABILITY(U)

Operational Concepts	General Improvement Required in Operational Capability Over Present Systems
1. Patrolling and operation of mobile check points	- Current improvement requirements will depend to a significant degree on the River Patrol Boat (PBR) field tests which are in progress in VN at time of writing - Preliminary information indicates that the noise of operation is undesirable
2. Support of amphibious operations:	
a. Troop, cargo, and equipment transport	- Increased operational speed - Improved passive resistance of the hull to the effects of an underbottom explosion of a mine device - Improved armor protection for personnel, cargo, and critical craft areas - More effective delivery of anti-personnel fire against area targets - Attainment of mobility in or on shallow water, mud, weed congested areas, marsh areas, and so forth - Noise suppression
b. Convoy protection and fire support	- Same as 2a plus - - Increased capability to close with an attacking element (surface or shore) and press a counterattack
c. Mobile command and control	- Same as 2a
3. Blocking secondary channels	- Increased selection of shallow-water mine systems
4. Mine Countermeasures	- Improved dragging for moored, controlled mine devices - Improved detection of mine devices - Additional capability on inland waterways to sweep for contact and magnetic-influence-type mines
5. Mobile general support of inland-waterway craft and aircraft operations	- Present support capability with converted ships is marginal due to draft and number of rotary-wing aircraft which may be supported by one ship

TABLE 4. SUPPORTING PROJECTS SUMMARY (U)

Deficiency Area	Description of Research, Development, Test, and/or Engineering Effort	Research	Development	Test	Engineering
1. Hull resistance to underbottom explosions.	- Build up the available data on the effects of underbottom explosions on inland-waterway craft				
	a. Detonate varying amounts of explosive over the range 30-100 lbs. The devices should be configured to give the directional explosive effect similar to the VC moored-mine device which has and is being used. Detonation depths should be from 2-20 feet. Pressure measurements should be obtained in polar planes at depths of 0-6 feet. Pattern and nature of the bubble should be recorded.	X		X	
	b. Subject hulls of various basic designs (vee, round, catamaran, etc.) and strengths to the explosions. Measure resistance and explosive effects under the controlled conditions. Test various explosive resistance and sinking materials in double-shell hulls.	X	X	X	
	- Translate results of test series into hull design criteria and characteristics for new craft listed in Table V-3.				X
	- Identify areas for continuing research.				
2. Sustained and maximum operating speeds.	- Primary emphasis should be placed on the availability of gas-turbine engines for inland-waterway craft. (Also associated with the noise-suppression problem).		X	X	X
	- A program for development and evaluation of steam-engine systems for inland-waterway craft should be initiated. (Also associated with the noise-suppression problem.) Initial priority is for application on patrol-type craft.	X	X	X	X
3. Integral armor protection.	- A program for development and evaluation of "space armor" for use on inland-waterway craft should be initiated. Primary threat is the 57 mm and 75 mm recoilless rifles.				
	a. Develop various detonating-screen designs (vertical overlapping bars, etc.)		X		X
	b. Test the effectiveness of the detonating-screen designs in protecting exposed hull areas above the waterline from 37 mm, 57 mm R.R. and 75 mm R.R. high explosive and armor piercing rounds using contact and delayed fuzes. The other critical test parameter is the off-set distance of the detonating screen from the hull.	X		X	
	- If favorable results are obtained, designate criteria and characteristics for space armor on new craft listed in Tables V-3 and V-4.				X
	- Develop armored turrets for 0.30 cal (or 7.62 mm) MG, 0.50 cal MG, 20 mm gun, and HV 40 mm G.L. positions on inland-waterway craft.		X	X	X
4. Weapon systems to deliver anti-personnel munition on an area target.	- Adapt for use on inland-waterway craft the MK 6 Mod 0 depth-charge projector (K-gun) and/or spigot mortar (Y-gun) to fire anti-personnel munition at an area target (approximately 150 by 50 meters).		X		X
	- Develop (or adapt) a white phosphorous bomblet and napalm munition for use by the K- and/or Y-gun systems.				

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TABLE 4. (Continued)

Deficiency Area	Description of Research, Development, Test, and/or Engineering Effort	Research	Development	Test	Engineering
	- Develop a high-explosive bomblet munition with mixed-bomblet detonation capability for part detonating on contact and part detonating a few feet above ground.		X		X
	- Test the above systems and munitions for effectiveness against simulated personnel targets in controlled experiments using representative concealment and cover.			X	
	- Select the best system for use on new craft listed in Table V-3, and determine need for continuing effort.				
	- Develop and evaluate a mass-launch rocket system for use against personnel in a linear area target. High explosive and white phosphorous rounds with contact and delay fuzes should be tested in controlled experiments. (Adaptation of the 2.75-inch FFAR should be considered.)		X	X	X
	- Develop and test a system for side mounting on craft a low velocity 40 mm array (low velocity grenade launcher round) using short, fixed and mounted firing tubes.		X	X	X
5. Noise suppression.	- Complete the present effort to build up available data and information on noise level of current craft before and after a feasible amount of acoustical treatment (present effort at U.S. Navy Marine Engineering Laboratory).			X	X
	- Based on the program results, develop criteria for acoustical treatment of present craft, or new craft with gasoline or diesel engines.				X
	- Develop improved components such as mufflers for gasoline and diesel engines which are adjustable with regard to critical parameters as a function of engine speed.		X	X	X
	- Develop and evaluate improved acoustical treatment for gas-turbine engine systems.		X	X	X
	- Initiate a program for development and evaluation of steam engines for inland-waterway craft. Such engines should be relatively quiet in operation. Initial priority is for application on patrol-type craft.	X	X	X	X

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(S) Other required areas of supporting project activity are associated with the capability to detect and/or neutralize moored mine devices as a part of mine countermeasure operations and shallow-water mines for use in blocking secondary channels. For mine countermeasure operations the most urgent requirement is completion of the present riverine sonar task at the U. S. Navy Mine Defense Laboratory. First priority is the modification of the "best" of the currently available small craft sonars (based on field tests in CONUS and SVN) for use on craft in a mine detection role. The second objective is the development of an improved sonar to effectively detect a moored mine device in inland waterways.

(S) There is a need for shallow-water contact type mines in several weights which are effective in water depths of 2 to 20 feet against indigenous type craft. It appears that mines in total weights of approximately 30 to 40, 75 to 85, and 120 to 130 pounds would provide an adequate range.

(C) New Craft. The PCF-Mark 1 (Swift) and the River Patrol Boat (PBR) have added a fast patrol capability on inland waterways. Further development, testing, or engineering effort to meet this operational concept will depend to a great extent on the results of operational field tests of the PBR which were in progress at the time of writing. Also applicable are the tests, presently in progress in South Viet Nam, of air-cushion-type vehicles. The suggested armed reconnaissance version of the Marsh Screw Amphibian (Table 6) would also be applicable for patrolling in areas not accessible by watercraft.

(S) The preferred watercraft (with modifications) from current inventory to provide troop, cargo, and equipment transport; convoy protection and fire support; and mobile command and control in support of amphibious operations have the five common general deficiencies previously listed. Several new craft and amphibians appear to be required to provide the increase in capability needed. There is also a need for a craft to improve mine countermeasure operations on inland waterways. Further modification of existing craft does not appear adequate to meet these requirements. The development of each of the new craft required is within present technical capability and will require development, test, and engineering effort. However, there is a dependency on the supporting projects discussed above. The general characteristics of the suggested watercraft and amphibians are given in Tables 5 and 6, respectively. Based on the qualitative analysis accomplished in the study, these craft and amphibians appear required to adequately improve operational capability in swamp forest areas containing a major river or channel network.

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TABLE 5. GENERAL CHARACTERISTICS - INLAND-WATERWAY CRAFT (U)

Mission	Maximum Draft, inches	Speed[1]		Capacity		Range, nautical miles	Armament	Armor Protection[3]	Engine Type	General Design Characteristics[5]
		Maximum knots	Sustained knots	Troops[2]	Cargo, tons					
Troop and cargo transport	48	20-25	17-20	60-65	15-20	150-175	2 - HV 40 mm G.L. 2 - Twin 0.50 cal M.G. 60 mm naval mortar; K-gun; or Y-gun LV 40 mm side-mounted arrays	Weapon positions Other crew areas Troop and cargo well Engineroom area Space armor	Gas turbine[4]	Over-the-side loading Sliding or extendable) unloading ramp Troop and cargo well Gun positions - 2 each side 1 aft (heavy-weapon station)
Troop, cargo, and equipment transport[6]	54	20-25	17-20	(7)	35-40	150-175	2 - HV 40 mm G.L. 2 - Twin 0.50 cal M.G. 1 - 20 mm gun 81 mm naval mortar; K-gun; or Y-gun LV 40 mm side-mounted arrays	Same as above	Gas turbine[4]	Front-ramp loading Troop, cargo, and equipment well minimum dimensions Length - 35 ft Width - 11 ft Height - 6 ft Gun Positions - 2 each side 1 aft (20 mm) 1 heavy-weapon station
Convoy protection and fire support	36	35	25-30	--	--	150-175	1 - HV 40 mm G.L. 1 - 0.30 cal (or 7.62 mm) M.G. with coaxial LV 40 mm G.L. 2 - Twin 0.50 cal M.G. 60 mm naval mortar; K-gun; or Y-gun LV 40 mm side-mounted arrays	Same as above (except no troop and cargo well)	Gas turbine[4]	Gun positions - 1 each side (Twin 0.50 cal M.G.) 1 forward 1 bridge-mounted (0.30 cal M.G. with coaxial LV 40 mm G.L. 1 heavy-weapon station

TABLE 5. (Continued)

Mission	Maximum Draft, inches	Speed[1] Maximum knots	Speed[1] Sustained knots	Capacity Troops[2]	Capacity Cargo, tons	Range, nautical miles	Armament	Armor Protection[3]	Engine Type	General Design Characteristics[2]
Mine-counter-measure craft[8]	30	20-25	17-20	--	--	100-150	1 - Twin 0.50 cal M.G. 1 - HV 40 mm G.L. LV 40 mm side-mounted arrays	Weapon positions Other crew areas Engineroom area Space armor	Gasoline or gas turbine[4]	Low magnetic signature Gun positions- 1 forward 1 aft

(1) At full displacement.
(2) Combat equipped.
(3) Criteria - 0.50 caliber machine gun at 20 meters.
(4) With acoustical treatment.
(5) Overpressure design criteria and basic hull type depending on results of hull test series.
(6) Additional mission of mobile command and control with a communications and control module designed to fit in the well.
(7) Troop capacity would be greater than normally utilized.
(8) Craft designed as a system to employ advance sonar equipment, provide an increased sweeping capability on inland waterways against moored contact mines or magnetic-influence mines, and provide an operating platform for diver personnel engaged in neutralizing or destroying the mine devices after detection.

TABLE 6. GENERAL CHARACTERISTICS - MARSH SCREW AMPHIBIANS (U)

Mission	Speed(1)			Capacity		Range, nautical miles	Armament	Armor Protection(3)
	Water, knots	Marsh, knots	Mud, knots	Troops(2)	Cargo, tons			
Troop and cargo transport	15-17	17-20	20-25	25	3.5-4	100-150	1 - Twin 0.50 cal MG 1 - HV 40 mm G.L. LV 40 mm side-mounted arrays	Weapon positions Other crew areas Troop and cargo area Engine and drive system Space armor
Armed reconnaissance and patrolling(4)	15-17	17-20	20-25	--	--	100-150	Same as above	Same as above (except no troop and cargo area)

(1) At full displacement.
(2) Combat equipped.
(3) Criteria - 0.50 caliber machine gun at 20 meters.
(4) Maximum dimensions: Length - 17 feet, Width - 10 feet.

Air Operations

(C) The principal improvements which appear required in air operations to support combat operations in swamp forest areas are associated with the deployment of a light armed reconnaissance type aircraft, and night operations for enforcement of a curfew. In addition, research and test effort is also required to improve the information and data available on the degradation in effectiveness of air delivered munitions in a swamp forest environment.

(S) The detection of personnel under a jungle, tropical forest, or swamp forest canopy does not appear yet within the technical state of the art. However, the capability of sensor systems for detecting signatures of insurgent operations is improving, and priority should be maintained on these programs.

(C) As a supplementary measure, illumination systems for rotary- and fixed-wing aircraft (such as a light reconnaissance type aircraft) should be exploited. The present heliborne illumination system (see main report [BAT-171-45] for details) should be improved to provide adequate illumination in an area diameter of 1200 to 1500 feet at an altitude of 3000 to 3500 feet. This would improve the one pass coverage over major channels and rivers, and further decrease the vulnerability of the illumination helicopter to small arms fire.

(C) The concept of an armed and armored airborne tank (see main report [BAT-171-45] for details) appears applicable for consideration in a curfew enforcement role at night over a swamp forest area. This concept involves the use of an armed and armored gondola, cable launched and recovered from underneath a Constellation-type aircraft. The gondola would contain five combat troops and approximately 350 square feet of armored plate. Illumination and weapon systems would be an integral part of its design. The gondola would be equipped with a ducted-fan motor for limited control. Other control methods would be cable control winches aboard the gondola and the aircraft. Theoretical study of this concept to date and the limited flight testing of a cargo delivery system on which the concept is based make it appear favorable.

(C) The effectiveness (or degradation in effectiveness) of airborne ordnance when used in a swamp forest has not been sufficiently evaluated. A research and test program to improve the information and data on this problem is required. The Joint Evaluation of Environments Program (JEEP) currently in progress at Eglin Air Force Base should be monitored for useful data.

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13. ABSTRACT

Applicable weapon systems, general operational concepts, and associated problems and requirements of combat operations in the swamp forest areas of South Viet Nam are studied. There are discussions on the physical characteristics of the swamp forest areas with emphasis on the Mekong Delta and the Ca Mau Peninsula; threats and potentials of swamp forest warfare; United States inventory of weapons systems applicable to swamp forest warfare; and the state of the technical art in the areas of swamp forest weaponry. Also discussed are the preferred weaponry inventories for swamp warfare, preferred operational concepts for this weaponry, and the research and development required to improve current capabilities. The effect of denying potable water on enemy efficiency in saline swamp forest areas is also considered.

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South Viet Nam	4,9		9			
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Strategy	8					
Warfare	4,8,9		9			
Environment	8					
Mekong Delta	9					
Ca Mau Peninsula	9					
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Development	8					
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Efficiency			7			
Enemy			9			
Salt water			9			
State of the art	8					
Availability			6			
Potable water			6,9			

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